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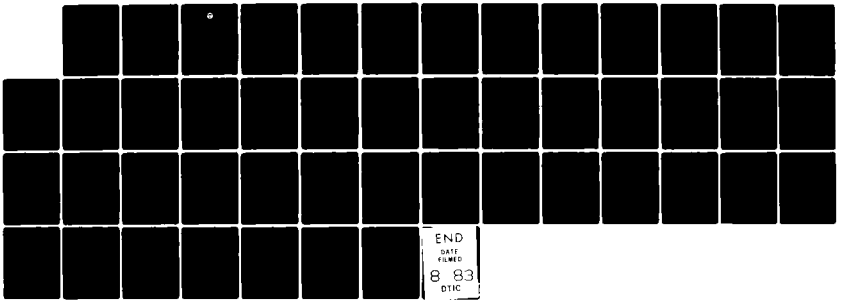

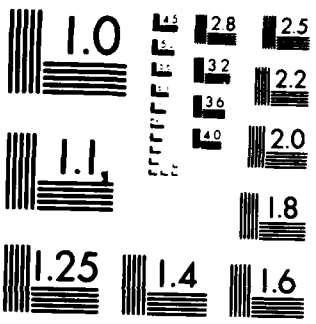

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MANAGEMENT PERSONNEL PERFORMANCE MONITORING GUIDE

AC MacMurray
VD Leonard

7 March 1983

Final Report

Prepared for
Naval Electronic Systems Command
Test and Monitoring Systems Office
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NAVAL OCEAN SYSTEMS CENTER
San Diego, California 92152

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CA 92152

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

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ADMINISTRATIVE INFORMATION

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This technical document contains guidelines to insure sufficiency of action by acquisition managers for the provision of adequate and cost effective on-line system-level test and performance monitoring capability in prime system acquisitions. These guidelines are time-oriented to the technical and contractual actions normal to the DSARC acquisition process. System-level test, and performance monitoring actions are highlighted to provide contrast with other engineering, technical and contracting actions.

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TABLE OF CONTENTS

SUMMARY

OBJECTIVE

This Technical Document (TD) presents guidelines for the timely implementation of on-line system-level test and performance monitoring capability into the design of military prime systems. The presentation of material is intended to stimulate detailed inquiries into substantive qualitative and quantitative issues concerning "state-of-health" of a system, in proper proportion with other design issues and requirements such as off-line test, maintenance and reliability, and logistic support.

APPROACH

The data in this TD is presented in flow chart, text, and checklist format as guidelines to program managers, engineers and technical staff. Interrelationship is maintained between flow chart numbered items and text paragraphs, for ready cross reference. As such, the text provides in-depth explanation of the flow charts, and the check list data provides extra assurance that key performance monitoring issues will be considered. The entire presentation is normal to the time-sequence flow of the DSARC process for major system acquisition. Although the prime thrust of this TD is directed toward requirements for monitoring the "health" of a system, it is not intended to overshadow the importance of off-line testing requirements. As such, program managers and engineers are urged to constantly seek a balance between on-line and off-line interests, toward elimination of false indications and testing ambiguities, resulting in the most reliable, useful and valuable mix of test and monitoring techniques.

INTRODUCTION

Each major system acquisition program has its unique features. Differences in time, cost, technnology, management, and contracting approach must be recognized. However, despite the differences, the basic acquisition process is common to all programs, being based on DoD Directive 5000.1 including OMB Circular A-109, both titled "Major System Acquisitions." Commonality is also apparent with DoD Instruction 5000.2 "Major System Acquisition Procedures." Figure 1 illustrates the basic acquisition process or cycle.

The principal activities in the major system acquisition process are iterative. As more knowledge of needs, alternative solutions, actual capabilities, resources, and priorities is acquired, some steps in the overall cycle may be repeated, to permit decisions to be made in a total system context. One such principal activity, system-level test and performance monitoring i.e. those functions involved in the determination of the "state of health" of a system during operation, is emphasized in this technical document. The flow charts depicting the Defense Systems Acquisition Review Council (DSARC) acquisition cycle illustrate primarily those activities that have interface or association with the performance monitoring activity. Program managers should exercise judgement and flexibility to "tailor" their programs according to unique features or limitations imposed.

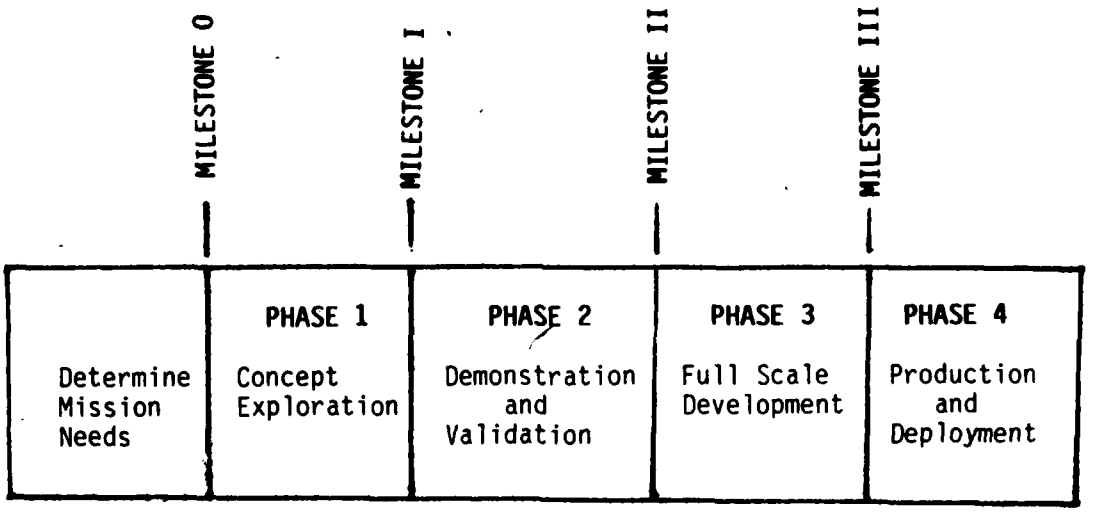


Figure 1. Major System Acquisition Cycle

PRE-MILESTONE 0

Activities in the Pre-Milestone 0 phase of the acquisition process identify and document a mission need. Its purpose is to summarize the requirements in preparation of gaining Secretary of Defense approval to explore the concept further. It also leads to the designation and appointment of a program manager. The flow of activity is depicted in Figure 2 located at the end of Section 1.

DETERMINATION OF MISSION NEEDS. DoDD 5000.1 and OMB Circular No A-109 require each DoD agency to conduct a continuing analysis of current and forecasted mission capabilities, technological opportunities, overall priorities, and resources. From this, are determined the needs as related to the ability to perform the operational mission. Needs are described in terms of the mission, purpose, capability, operating constraints, and schedule and cost objectives. This action presents the first opportunity to identify system-level test and performance monitoring objectives to be brought into focus as system requirements in subsequent acquisition cycle phases.

OPERATIONAL REQUIREMENT (DODI 5000.2). In recognition that a capability to monitor system performance during operation increases mission effectiveness in terms of enhanced maintenance capability and greater command decision visibility, the requirement for performance monitoring capability should be seriously considered for inclusion in the operational requirement. In such circumstances, applicable conceptual performance monitoring goals and parameters should be indicated in the statement of operational requirement.

PREPARE AND APPROVE THE MISSION ELEMENT NEED STATEMENT (MENS) (DODD 5000.1, DODI 5000.2.) When the analysis of current and forecasted mission capabilities identifies a deficiency in existing agency capabilities, or an opportunity to establish new capabilities in response to a technological advantage, such deficiency will be formally set forth in a mission need statement. As such, the Mission Element Need Statement (MENS), described in DoDI 5000.2 Encl. 2, is completed by the cognizant Naval Material Command (NAVMAT) or Systems Command (SYSCOM) component. Its approval by the Secretary of Defense (SECDEF) is authority to proceed to the next acquisition phase.

Constraints of historical origin that should apply to any acceptable solution, will be stated initially in the MENS. Examples of such constraints are operational, logistics and design considerations, resource limits, and timing requirements. Performance monitoring requirements will seldom be the singular motivation for the acquisition of a new system.

However, any performance monitoring contribution to improved mission effectiveness warrants consideration as a performance requirement in the "Assessment of Need" portion of the MENS by citing the inadequateness of system readiness without it, and the resultant degradation of mission performance. Approval of the MENS constitutes the milestone decision by SECDEF to proceed into Phase 1, concept exploration, to identify and to explore alternative solutions. It does not commit to a particular solution at this point.

SECTION 1

CONCEPT EXPLORATION PHASE

1.0 The concept exploration phase of the acquisition process provides commitment only to identify and to explore alternative solutions. A broad base of qualified manufacturers is sought initially, to provide the widest range of alternative solutions capable of satisfying the mission need. These are subsequently reduced to a selected number who offer best technical and cost-effective solutions of the mission need. The flow of activity for this phase is depicted in Figure 2 at the end of this section.

1.1 INITIAL PROGRAM ACQUISITION STRATEGY (DODD 5000.1, DODI 5000.2). Development of the initial program acquisition strategy is usually accomplished in broad terms by NAVMAT or System Commanders as soon as possible after Milestone 0. It is a reflection of the management concepts to be used subsequently by the program manager in directing and controlling all elements of the acquisition, in response to specific goals and objectives set to assure satisfaction of the approved mission needs.

1.2 ASSIGN PROGRAM MANAGER (PM) (DODD 5000.1, OPNAVI 5000.1). A program manager is designated by the Chief of Naval Material or a Systems Command as soon as possible after the Milestone 0 decision. Program objectives are developed that set forth the capability (in mission needs, not equipment solution terms) cost, and schedule goals being sought in the system acquisition program. These objectives are incorporated in a written charter, which defines the authority, responsibility, and accountability of the program manager.

1.3 RECRUIT STAFF/TAILOR ACQUISITION STRATEGY (DODD 5000.1, DODI 5000.2). An initial responsibility of the program manager is to recruit a staff, or to identify a team with the requisite skills and experience to manage the assigned system. Another of the program manager's first tasks is to develop, with his staff, an efficient, effective and economical acquisition strategy encompassing the technical, business, and management functions of the entire acquisition process. This strategy forms the basis for solicitation requirements for system level alternatives, as well as subsequent acquisition and management plans. Initially limited, it is be broadened and refined as the program progresses. Table 1 contains a checklist of on-line test and monitoring items for consideration in the development of acquisition strategy.

Have the following on-line test and monitoring aspects been considered in the development of the program manager's acquisition strategy?

a. Has a staff member been identified to assure coverage of the performance monitoring aspects?

b. Have the following performance monitoring strategies been considered?

- Identification of overall performance monitoring goals
- Impact on design, i.e., compatibility with other disciplines such as R&M, accessibility, safety, support, etc.
- On-line and off-line diagnostics requirements
- Impact on support, i.e., maintenance, repair, parts
- Identification of development and operational testing requirements
- Configuration management applications

c. Are overall testability aspects constrained by the operational mission, i.e., as with an orbiting, unmanned space craft, thus requiring special performance monitoring/self-test/fault tolerance consideration?

d. Is requirement for auto-calibration capability contemplated?

Table 1. Acquisition Strategy Checklist

1.3.1 Design Model. Program Management Office (PMO) design and test engineering personnel will develop a conceptual design model using mission needs as a basis, and applying the proven precepts of such disciplines as maintainability, reliability, availability, human engineering, and safety. Appropriate criteria of testability, which is emerging as a stand-alone design discipline and which includes on-line test and monitoring concepts, should also be considered in the design model development.

Constraints due to the unique nature of the mission can greatly restrict the testability possibilities, and must be considered in order to fit the conceptual model into the operational requirement framework. Such constraints might, for example, be imposed by a requirement for unusually long hours of unattended system operation.

Severe restrictions on weight, form, fit, power consumption, etc. might preclude the inclusion of additional components or hardware partitioning which would improve testability/accessibility. For example, an unmanned spacecraft will require little or no hands-on testability designed into it. It is envisioned that such a vehicle will experience very long hours of unattended operation, thus requiring heavier than usual reliance on built-in state-of-health determination and self-maintenance capability. Design considerations for attaining such a capability as they apply to fulfillment of the mission include self-test and fault-tolerance techniques. Self-test employing built-in test (BIT) techniques and possibly built-in test equipment (BITE) offers the capacity to detect and possibly isolate system faults without the use of external test equipment. The implementation of BIT can take many forms, can be cursory, or at great depth. At this stage of a program, the engineering personnel should be concerned with the general concept: they should consider the contribution of self-test techniques to mission fulfillment, while recognizing constraints as described above for implementation of testability techniques.

Fault-tolerant techniques are typically applicable to systems wherein a very high degree of reliable operation is vital, as in space missions, for example. Since fault-tolerance techniques tend to involve considerable additional hardware, the natural system constraints must be considered carefully, because the penalties for inclusion of such significant additional circuitry or hardware may rapidly push a concept beyond the realm of feasibility. The great strides being made in the scale of integration of circuits, however, allow for considerable amounts of additional circuitry, such as redundant integrated circuit (IC) processors, memory, etc, to be employed at little cost or penalty.

The above-referenced aspects of design must be considerd in the broadest sense to clarify fulfillment of mission needs, while not suppressing the creativity and competition aspects encouraged in this stage of the acquisition process.

Formulation of data for the PMO System Engineering Management Plan (SEMP) should be initiated at this time for inclusion in the acquisition strategy.

1.3.2 Support Model. Integrated Logistics Support (ILS) planning impacts upon and, in turn, is impacted by the engineering activities throughout the system life cycle. Toward development of the support model, support descriptors are fashioned from the criteria and constraints of the stated mission needs. These descriptors include: unique operational constraints, basing and deployment concepts, maintenance concepts, repair-level concepts, personnel and training needs, and support/test eqipment constraints. Anticipated performance monitoring requirements envisioned at this juncture in the acquisition process will be considered in forming the support model. Quantitative and qualitative values for ILS descriptors should be attempted as early as possible, even to the extent of obtaining these values from recent past historical data.

In addition to developing the basic support model, ILS activity by the PMO in the concept exploration stage should identify ILS Plan requirements, Logistic Support Analysis (LSA) requirements and LSA data elements per MIL-STD-1388, and Level of Repair (LOR) constraints per MIL-STD-1390.

1.3.3 Initial System Test and Evaluation Goals. A prime purpose of Test and Evaluation is to assess the chance that some element of the acquisition process may produce an unintended result. Therefore, test and evaluation planning is initiated as early as possible. During the concept exploration phase, test and evaluation reqirements are initiated in the form of broad-based, development test plans and test procedures documents. Emphasis will be placed on Development Test and Evaluation (DT&E) requirements when appropriate to assist in the selection of alternative system concepts.

1.3.4 Configuration Management Policy. The extent of application of the configuration management (CM) discipline to the system envisioned for fulfilling a mission need, should be initiated in the concept exploration phase. This determines the initial CM policy which will encompass basic planning and procedural information for the program manager's CM plan. This plan will be updated periodically as the acquisition takes shape. The CM policy should also provide the basis for defining contractor CM plan requirements.

CM actions on which performance monitoring may have impact, include:

- CM plan as it relates to specifications preparation
- Determination of primary interfaces
- Documentation for baselines
- Configuration audits
- Mission constraints requiring unusual on-line testing/monitoring requirements

1.4 PREPARE PRELIMINARY SYSTEM SPECIFICATION (MIL-STD-490, NAVMAT I 5000.22A). Based on mission needs, a preliminary system specification is prepared by the program management office staff, defining the system's operational requirements and environment, characteristics, design, development, support and test requirements. This specification, prepared in MIL-STD-490 format, will be provided to interested contractors as part of a Request for Proposal (RFP) soliciting alternative solutions to the mission need. The purpose of the government-produced system specification is to consolidate, to set a common base, and to present mission needs. It should not diminish competition by constraining contractor innovation. Contractors selected to continue into advanced stages of the acquisition will be provided the opportunity to update the preliminary system specification based on their alternative solutions.

The following on-line test and monitoring applications and management planning factors should be considered for inclusion in the preliminary system specification.

1.4.1 Incorporate On-Line Test and Monitoring Requirements. The following specified values (percentages or numbers) should be appropriate for the concept at hand, and are not considered as generally standardized values. However, at this early stage in the procurement cycle, actual values for many of the on-line testability or monitoring parameters may not be determinable, necessitating use of applicable historical data when available. Computer values should be added in the finalized system specification as they are determined. However, any of the following listed parameter values which are already known and are important to the fulfillment of the basic mission need should be included in the preliminary system specification.

- **False Alarms Percentage.** Indicate maximum allowable percentage of fault indications which may be false alarms, or how many false alarms per n hours of operation are acceptable; n (typically) equals one thousand or one million.

- **Mean Fault Detection Time.** For monitoring devices, specify requirement(s) on maximum times to either detect or indicate a fault once it has occurred.

- **Mean BIT Running Time.** Specify maximum allowable time to verify by means of BIT that, indeed, a failure has occurred.

- **Test Monitoring Thoroughness.** Specify a percentage value of all functions to be monitored. At system level, monitoring should provide a one hundred percent assurance that all major functions are operating.

- **Maintenance Personnel and Operator Skill.** Indicate that utilization of low-skilled operator personnel is made possible by comprehensive BIT and on-line performance monitoring.

- **Availability.** The availabilities of systems with BIT and on-line monitoring should be specified to some probability of survival. MIL-STD-721B defines availability as a measure of the degree to which an item is in the operable and commitable state at the start of a mission, when the mission is called at an unknown (random) point in time.

- **Memory Requirement.** Minimum-allowed memory for BIT functions must be stated.

1.4.2 Integrated Logistic Support Plan (ILSP). The development of an on-going system maintenance plan should be considered for large systems which will utilize a significant amount of on-line performance monitoring techniques. Such a plan would include:

- An estimate of the man-hours required to perform the necessary system maintenance should be made in order to compute the system Mean Time to Repair (MTTR) and the Mean Time to Fault Locate (MTFL) for LSA and LOR application.

- Any foreseen, unique maintenance of performance monitoring requirements or problems, such as deployment of a system in a hostile environment, where special telemetric techniques would be required to relay performance data from the remote application site back to a manned control center, should be covered at this early stage, if possible. This will provide the bidding contractors time to work out viable potential solutions early in the acquisition cycle, avoiding problems later.

1.4.3 Test and Evaluation Master Plan. Requirements for contractor DT&E and OT&E plans should specify the proper test environment to enable testing of any performance monitoring, BIT, or other self-test application in the system. The preferred technical approach to a system's performance monitoring, and the necessary formal verfication methods to be applied, should be identified.

1.4.4 Configuration Management Plan Requirements. Baselines are established at recognized points in a program where it is necessary to define a formal control departure point for any future changes in either performance or design.

Provision should be stated for contractors to track and to provide appropriate modifications to any self-test/performance monitoring techniques whenever changes to the prime system are incorporated. It is advisable to place monitoring and self-check functions under software control to the maximum extent. This permits modifications to the monitoring/self check structure to keep pace with changes to the system hardware or performance, thus averting false alarm indications.

1.5 PREPARE RFP FOR ALTERNATIVE SOLUTIONS. (DODD 5000.1, DoDI 5000.2). The Request For Proposal (RFP) should explain the need in mission (not equipment) terms, schedule objectives and constraints, program cost objectives, capability objectives, and operating constraints. The solicitation, in terms of mission need is the key to this portion of the acquisition process. The contractors should be free to propose their own technical approach, main design features, and alternatives to schedule, cost, and capability goals. The purpose of this type of solicitation is to gain the benefits of industry innovation and competition, and not to introduce constraint by preordained or prematurely selected equipment approaches. It should provide background information on prior studies, constraints inherent in the need, and technology developed by Government laboratories or at Government expense. The accessibility of related Government information should be provided as part of the solicitation. The solicitation should not restrict the contractors by specifying or referencing Government specifications and standards. Instead, a type I statement-of-work (MIL-HDBK 245A), is used which defines technical requirements in terms of goals rather than in quantitative/qualitative terms. Broad definitions needed to define the capability objectives of the mission needs, including performance monitoring goals and interface with other design specialties, are obtained from the technical staff inputs to the acquisition strategy. Additionally, documents produced in-house, such as the System Engineering Management Plan (SEMP), Integrated Logistics Support Plan (ILSP), Level of Repair (LOR) Analysis, and Logistics Support Analysis (LSA), Test and Engineering Master Plan (TEMP) and Configuration Management Plan (CMP), will be initiated in this phase of the acquisition process. Table 2 contains a checklist of on-line test and monitoring items for consideration as inputs to this RFP. Table 3 contains sample RFP task statements for use as applicable.

1.5.1 Pre-RFP Briefing. In the interest of expediting the solicitation process for the concept exploration phase, program managers are encouraged to conduct orientation briefings for industry, and, where appropriate, allow industry to comment on a draft of the solicitation and the system acquisition strategy. Other objectives are to remove inhibitors to innovative solutions in response to the solicitation, and to improve achievement of program objectives. The pre-solicitation briefing presents the opportunity for discussing, among other issues, the on-line test and monitoring aspects of the mission needs. Any Government historical data in this line should be made available to contractors at this time. The above applies for post-RFP bidders' conferences as well.

1.6 CONTRACTOR'S CONCEPTUAL FEASIBILITY STUDIES/PROPOSAL (DODD 5000.1, DoDI 5000.2, SECNAV I 5000.1). Solicitations are sent to a selected, broad base of qualified firms to obtain the widest range of alternatives capable of satisfying the mission need. Interested contractors will prepare technical and cost proposals based on the RFP requirements.

The following on-line test and monitoring goals relating to mission needs should be addressed.

a. Does the RFP explain performance monitoring objectives in terms of contribution to mission effectiveness and life cycle cost (LCC), through improved maintenance and enhanced command decision capability?

b. Have sufficiently broad, performance monitoring goals been stated, based on the operational mission and on foreseen maintenance environment?

c. Is requirement included for the contractor to explain his understanding of the following performance monitoring requisites, as may be required?

- Compatibility between on-line and off-line use of test-points, diagnostics and sensors
- Optimum mix of on-line testing/monitoring, versus off-line testing based on the operational mission
- Timing of the performance monitoring function with system operation
- Potential for performance monitoring to decrease reliability and increase testability problems, and how he intends to preclude this
- Consideration of self-test and fault-tolerance design principles
- Effect of performance monitoring on level-of-repair and life cycle cost
- Effects of on-line test and monitoring capability on acquisition, ownership, and life-cycle costs
- Optimum mix of hardware/software to effectively implement performance monitoring and self-test functions
- Scheme for accessibility of monitoring and self-test functions as applicable to hardware and software modularization, external test/control points, emulation capability

Table 2. Alternative Solutions RFP Checklist

a. The contractor shall describe his procedures for the application of the on-line test and performance monitoring technologies as they may apply in fulfillment of the stated mission needs. As a minimum, the following shall be considered:

- Identify the broad parameters for an on-line testing/monitoring capability including

  oo Self-test
  oo System Status monitoring
  oo Fault detection
  oo Fault isolation
  oo Fault tolerance

- Identify broad parameters for manual and automatic off-line testing

- Project an optimum mix of on-line test/monitoring and off-line test capabilities

- Describe procedures planned to assure optimum compatibility between on-line and off-line test points, sensors, and diagnostics

- Describe planned parameters for timing the on-line, self-test/monitoring functions with system operation

- Plan steps to preclude the on-line test and monitoring functions from appreciably decreasing reliability and increasing testing problems

b. The contractor shall indicate how he proposes to relate his envisioned on-line system test and monitoring technical impacts to cost and schedule impacts.

c. The contractor shall conduct and record Life-Cycle Cost analysis data of off-line versus on-line test capability.

d. The contractor shall conduct and record Life-Cycle Cost analysis data for use of BIT versus no BIT.

e. The contractor(s) Design for Testability (DFT) features shall project level of technology, i.e., Large Scale Integration/Very Large Scale Integration (LSI/VLSI) opto-electrical, etc., devices in broad parameters.

Table 3. Conceptual RFP Task Statements

1.7 PROPOSAL REVIEW AND SELECTION (DODD 5000.1, SECNAV I 5000.1). Proposals are evaluated and the most promising concepts selected for further exploration. The selection is based on review and evaluation by a team of experts mustered from within and outside the organization responsible for management of the acquisition effort. The evaluation must consider the technical capability of the concept to fulfill mission needs, including the resources required. When it appears that the need may require extraordinary methods of system monitoring or on-line testing application, the proposal evaluation team should verify or determine that the proposal solution is consistent with the need as stated in the RFP.

Other evaluation considerations, on which on-line test and monitoring could have impact, include: acquisition and ownership costs, time to develop and procure, and the relevant accomplishment record and competence of key personnel of the competitors in the self-test/self-repair technologies.

The purpose of the evaluation is to select a number of contractors providing the best technical solutions within reasonable costs that will fulfill the stated mission need. Table 4 contains a checklist of on-line test and monitoring items for consideration in proposal evaluation.

1.8 FINALIZE AND FORWARD DECISION COORDINATING PAPER. (DODI 5000.2, SECNAV I 5000.1, OPNAV I 5000.46). The purpose of the Decision Coordinating Paper (DCP) is to provide documentation for use by the Defense Systems Acquisition Review Council to formulate a recommendation for the Secretary of Defense (SECDEF) Milestone decisions. As major contributor to the DCP, the program manager and his staff initiate action in conjunction with the Navy's sponsoring agency to prepare this document for the Milestone I decision. The format is described in DoD Instruction 5000.2. Goals and thresholds for all aspects of projected on-line testability functions that have potential to drive system effectiveness and costs will be recorded in the DCP. Examples of these goals and thresholds include: system status monitoring, self-test, fault detection, and fault tolerance. Annex A to Enclosure 3 of DoD Instruction 5000.2 provides the format for recording these, as well as other performance data.

1.9 DECISION COORDINATING PAPER (DCP) APPROVAL (DODD 5000.2, SECNAV I 5000.1, OPNAVI 5000.46). Approval by the SECDEF is contingent on the sufficiency of the selected alternatives to fulfill the mission need at reasonable cost. SECDEF approval of the DCP establishes Milestone I and is approval for continued exploration of alternative concepts by the successful contractors.

Contractor's proposals should be assessed for degree of use (as applicable) of the following on-line test and monitoring considerations.

a. Does the evaluation team include person(s) adequately qualified in areas of design for testability, or self-test and monitoring?

b. Have the following considerations been evaluated considering the impact of on-line test and monitoring?

- Appropriate contribution to fulfillment of mission needs
- Acquisition, ownership and life-cycle costs
- Procurement time

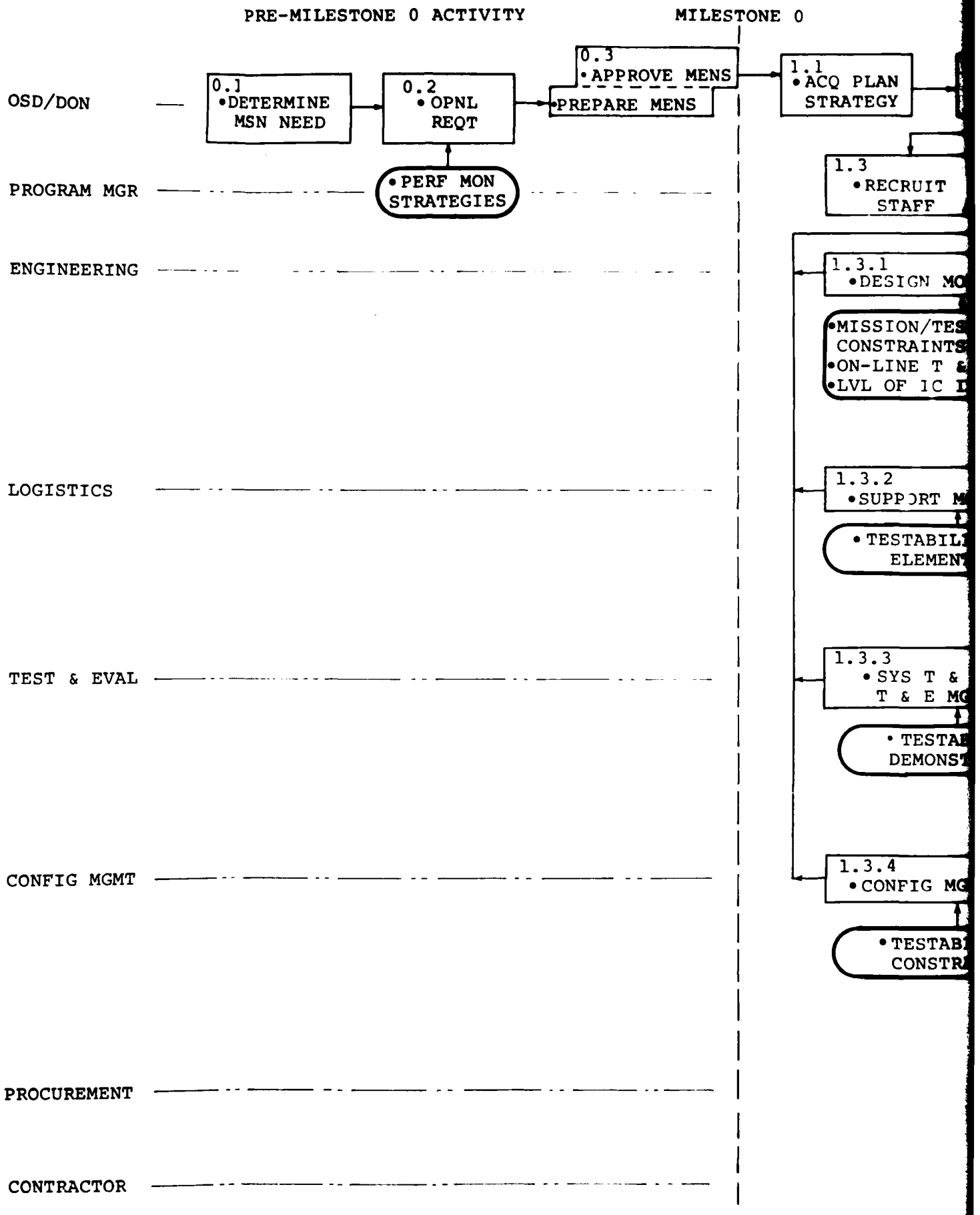
c. Have broad parameters been outlined for the following performance objectives, as may be applicable to projected on-line test and monitoring usage?

- Fault detection
- False alarm rate of occurrence
- False alarm percentage of indicated faults
- Fault isolation resolution
- Fault isolation percentage
- MTTR
- Mean BIT running time
- Percentage of functions BIT tested
- Percentage of all functions monitored
- Consideration of complexity of BIT impact upon overall system complexity (and hence reliability).

d. Have all proposals been reviewed for adequacy in meeting the following design for accessibility and monitoring requirements?

- Hardware modularization
- Software modularization
- External test/control points
- Emulation capability (ICE)

Table 4. Conceptual Proposal Evaluation Checklist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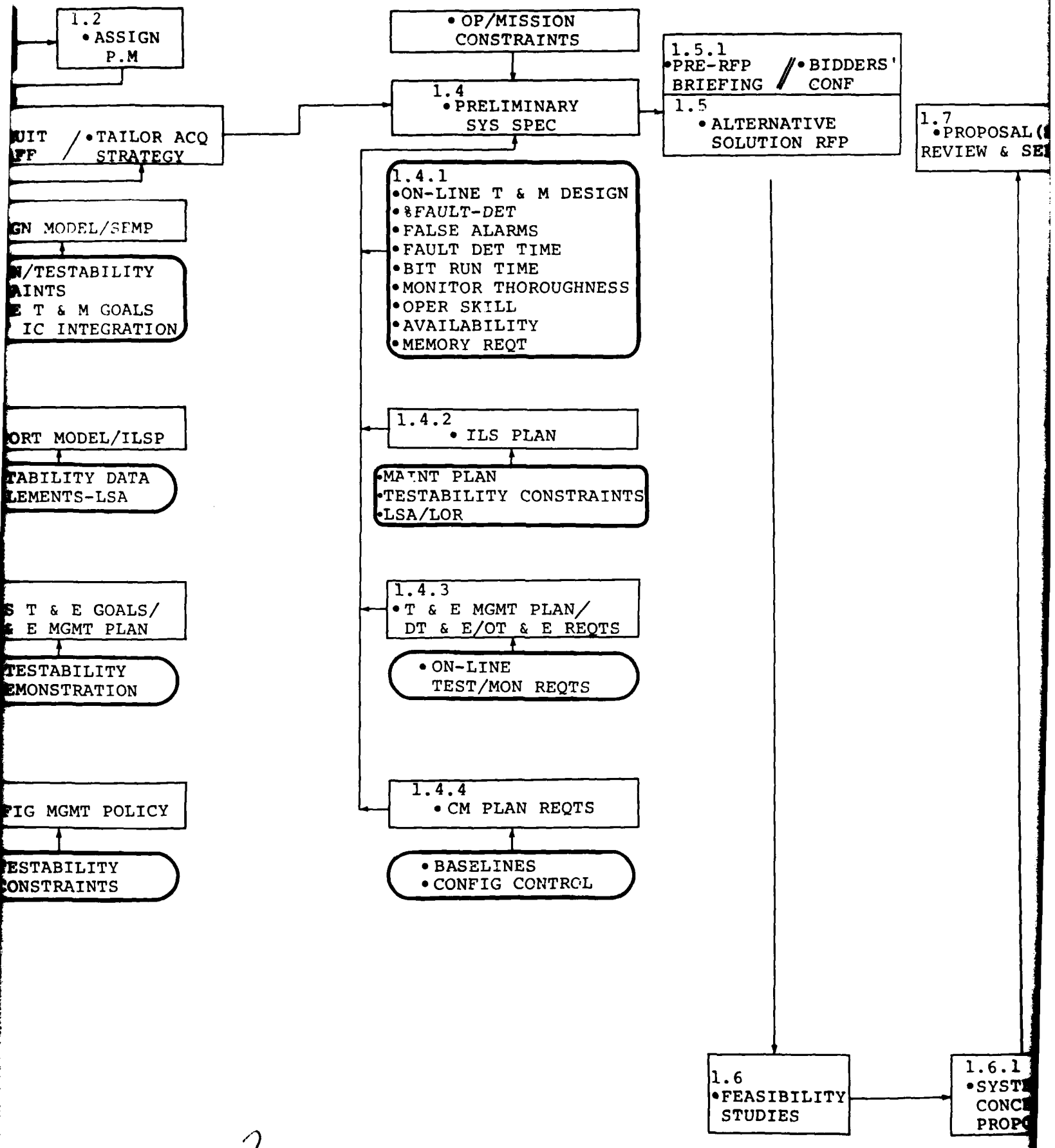
- CONCEPT EXPLORATION PHASE -



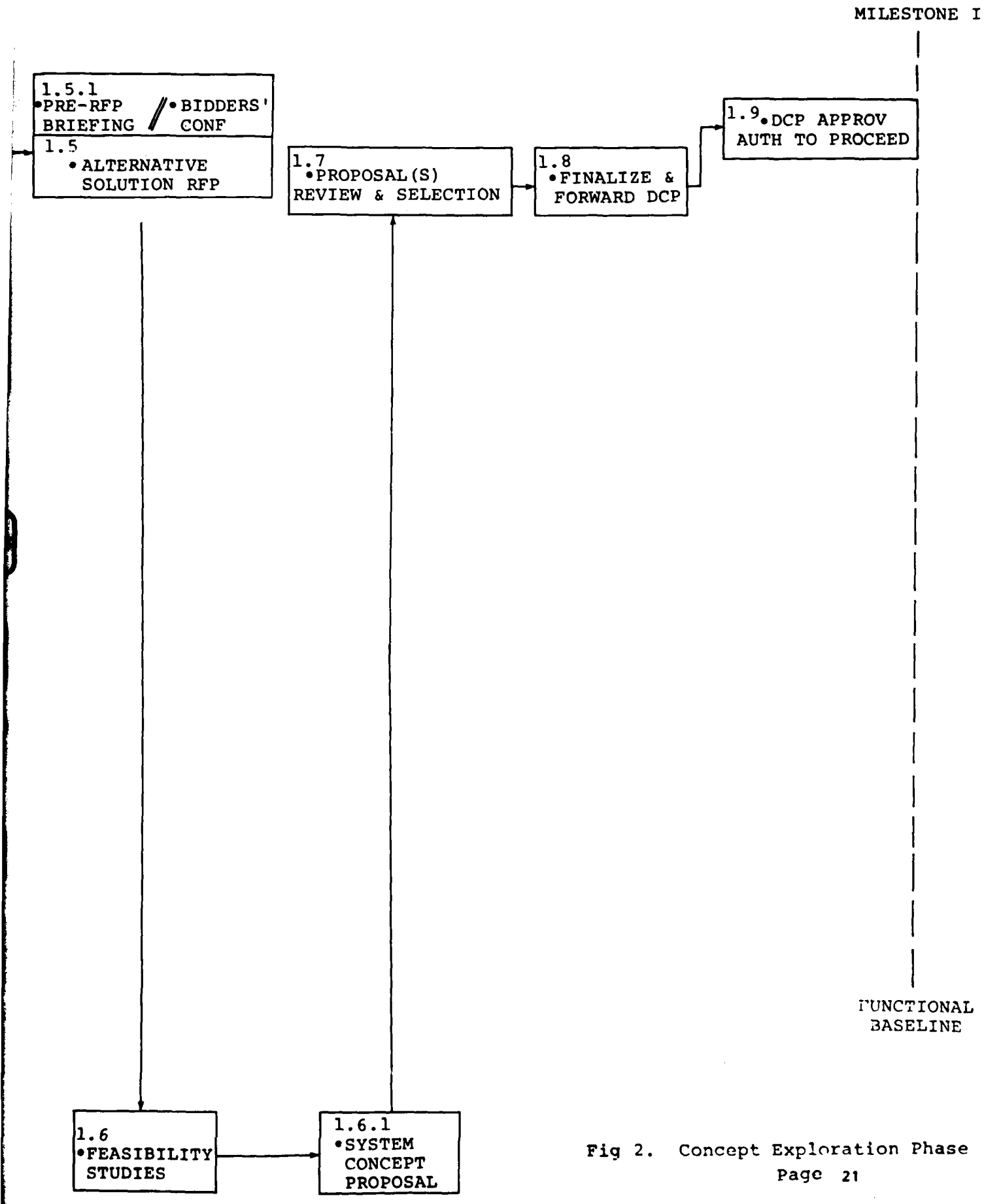


Fig 2. Concept Exploration Phase

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SECTION 2

DEMONSTRATION AND VALIDATION PHASE

2.0 This phase of the acquisition provides increasingly expanded definition of the alternatives selected at the conclusion of the concept exploration phase. Requirements for on-line test and monitoring capability, such as operational status monitoring, self-test and fault tolerance, also take shape in the process. Integration of this capability with all other allied design engineering specialties, such as R&M and accessibility, is made to optimize the overall performance and cost aspects of these interrelated disciplines. The flow of activity for this phase is depicted in Figure 3 at the end of this section.

2.1 AUTHORITY TO PROCEED (DODI 5000.2, SECNAVI 5000.1). SECNAV approval of the DCP constitutes authority for the acquisition to proceed into the Demonstration and Validation Phase. In anticipation of such authority, specialty plans to be produced by the contractors, such as the ILSP and the T&E management plans, should be identified. Since no current compliance document exists for invoking a testability plan, this requirement should be specified by a Statement of Work task statement.

2.2 ISSUE DEVELOPMENT CONTRACT(S) (DODD 5000.1, SECNAVI 5000.1). Continuation of competitive development into the advanced development stages should be pursued in interest of getting the best product at the best price. As such, on receipt of the SECDEF authority to proceed, contracts are issued to those contractors whose proposals were judged as having capability to solve mission need economically. Consideration should be made for continuing as a single-source acquisition only where urgency of need, or the absolute excellence of one proposal is evident over all others. The contract should provide for refinement of the technical, costs, and schedule efforts through requirements to update the system specification, as well as for system-level prototype testing, initial design reviews, and the initiation of Type B Prime Item Specification drafts.

2.3 SYSTEM DEFINITION, TRADE-OFFS HARDWARE/SOFTWARE PRELIMINARY DESIGN (PRELIMINARY SYSTEM SPECIFICATION, MIL-STD-1388). The principal activities of the contractor(s) during the Demonstration and Validation Phase are to verify concept(s) and to gather data for use in defining the system design in the Full Scale Development Phase. System definition is continually refined, first through trade-off of pure design factors based on experience and historical data, to arrive at a design model. Subsequent trade-offs will include cost and logistic support factors; further refined by Logistic Support and Level of Repair (LOR) Analyses to produce increasing definition of qualitative and quantitative logistics and maintenance support requirements. Refinement in predictions of logistic support costs in funds and other resources at all levels of

repair, is also obtained from these analyses. Resultant on-line testability and monitoring application may provide the optimum system configuration, depending upon operational requirement peculiarities. Additionally, on-line concepts such as fault monitoring and detection, system status monitoring, and fault tolerance, should be considered in the trade-offs and logistics analyses to arrive at the most cost-effective technically adequate solution.

2.4 SYSTEM REQUIREMENTS REVIEW (MIL-STD-1521, MIL-STD-499). The SRR is conducted when system functional requirements become evident as a result of demonstration and validation. The purpose of the SRR is to review progress and direction of the contractor's system engineering management activity, particularly the status of system/subsystem functional identification and allocation of performance and design requisites to the identified functional subsystems. The SRR should ascertain the sufficiency of testability in the proposed system to assure that proper balance and compatibility is planned between the proposed on-line functions (monitoring/self-test/self-maintenance), and the off-line functions (manual test/semiautomatic test and ATE). The minimization of false monitoring and testing indications and ambiguities should be a goal to be validated in this phase. Table 5 contains a checklist of the major on-line test and monitoring items to be checked at the SRR.

2.5 UPDATE PRELIMINARY SYSTEM SPECIFICATION (MIL-STD-490). The preliminary system specification is updated by the contractor(s) to reflect the changes made during the demonstration and validation efforts.

In reviewing the updated draft of the system specification, the program office should insure that on-line test and monitoring functions have been identified, that they contribute to the mission-need solution, and that performance characteristic values and parameters are determined.

Baselines may be established at any time that it may be necessary to define a formal departure point for the control of future changes in performance or design. The functional baseline is most commonly defined by a system specification, such as the preliminary system specification prepared in-house. For purposes of this document, the functional baseline is set when the contractors' update of the preliminary specification is approved. All subsequent system performance or design changes in hardware, software or firmware (including the system specification), must be handled as configuration management changes.

2.6 PROTOTYPE/PAPER STUDY TESTING (DODD 5000.3). Early test and evaluation of on-line test and monitoring concepts lends itself readily to the following means of testing:

- **Paper Studies.** Review of historical testing reports conducted on similar previous concepts, can be used to determine and clarify the basic T&E requirements and structure.

Contractor Design for Testability (DFT) activities to be checked during the SRR should include the following items as applicable:

a. Within the basic requirement of fulfilling or solving mission needs, do the operational requirements tend toward the application of on-line test and monitoring techniques....

- as the sole testing capability?
- in conjunction with off-line testing?
- not at all?

b. Has sufficient study/analysis been accomplished to ascertain an optimum mix of on-line and off-line capability to determine system "state-of-health" and to isolate or correct faults?

c. Are on-line test and monitoring functions represented in system functional flow analyses?

d. Do trade-off studies address system on-line test and monitoring functions in hardware/firmware/software uses?

e. Do system cost and effectiveness analyses reflect consideration of on-line test and monitoring variances for both Design to Cost (DTC) and Life Cycle Cost (LCC) as follows:

- On-line versus off-line testing/monitoring capability
- BIT versus no BIT
- Fault tolerance capability versus manual repair methods
- Self calibration capability

f. Have analyses/trade studies been conducted to determine that integration of on-line test and monitoring design principles will support the other specialty disciplines such as reliability and maintainability?

g. Has on-line test and monitoring capability been successfully initiated in preliminary designs at the system/subsystem levels?

h. Have test plans and procedures included requirement to demonstrate the planned on-line test and monitoring concepts?

Table 5. System Requirements Review Checklist

- **Existing Systems.** The use of similar existing systems, modified as necessary, should be considered in early estimations of operational effectiveness and suitability.

- **Hardware Prototyping.** The use of a breadboard/brassboard fabrication should be considered. Construction should emulate the operational system performance objectives. Prototyping is especially applicable to demonstrating and validating on-line test and monitoring circuits and software routines, as well as the functional compatibility of same with other disciplines.

2.7 PREPARE SOW FOR FULL SCALE DEVELOPMENT (FSD). When it is advantageous to continue the competition into full scale development, a Request For Proposal (RFP) is prepared. This RFP is issued during the validation phase to permit timely response by contractors so the selection process can determine the best one or two alternatives/contractors to proceed into FSD. When further competition is not necessary and approval is granted to continue, the FSD effort will be put out on contract. In either case, the statement of work requirements should be concisely defined and stated to insure that derived system performance parameters, including on-line test and monitoring criteria, are translated into logistically supportable, demonstrable, and cost-effective performance requirements for Configuration Items (CIs). Table 6 contains task statements of on-line test and monitoring considerations for the Full Scale Development SOW.

2.8 PREPARE DEVELOPMENT SPECIFICATION DRAFTS (MIL-STD-490, MIL-STD-483). As the performance parameters for a needed capability are refined in the system specification, they are translated into performance requirements for lower tier Configuration Items. Such derived requirements should be specified in the SOW for reflection in contractor-produced Development Specifications. These requirements should be stated in sufficient detail to insure positive tracking into CI hardware and software products.

In review of these contractor-produced specifications drafts, the program office should insure that SOW requirements are met.

2.9 SYSTEM DESIGN REVIEW (SDR) (MIL-STD-1521, NAVMATI 4130.1). This review is conducted when the system requirements and design approach are defined. Its purpose is to evaluate the optimization, traceability, correlation, completeness, and the risk of the allocated requirements, including corresponding test requirements. This review includes all analyses, trade-offs and other studies, from which total system requirements evolved. Table 7 contains a checklist of on-line test and monitoring items for consideration at SDR.

The following Design for Testability (DFT) task statements are directed at design requirements for on-line test and monitoring architecture, to be reflected in Development Specifications. Design shall consider actual noise environment in interest of suppressing false alarms.

a. The design goal for Percentage of Faults Detected (i.e., fault coverage) shall be ____ percent or greater of the total known possible fault population.

b. The contractor's design for Percentage of False Alarms to total false indications, shall not exceed ____ percent. False alarm determination may also be stated as a discrete number, as follows:

- o The acceptable number of false alarms shall not exceed ____ per _____ hours of operation.

c. The contractor's design for Mean Fault Detection Time must not exceed _____ (selected units of time) to detect or indicate the presence of a fault.

d. The contractor design for Mean Bit Running Time [illegible] that a maximum of _____ units of time is needed to [illegible] fault is in fact, a failure.

e. The contractor shall design Test [illegible] (percentage of all functions which are [illegible] greater than _____%.

NOTE: A comprehensive application of BIT techn[illegible] the utilization of lower-skilled, operating/maintenance [illegible] should be a consideration in decisions on the extent of BIT [illegible] as its design. Hence: design of the fault or system-status [illegible] (printed or displayed) shall be appropriate for the skill [illegible] operator/user.

f. The contractor shall design system, subsystem and configuration items to operator/user skill levels _____; and maintenance skill level ____ at the ____ level of maintenance.

g. The contractor shall design for an Operational Availability of no less than _____ percent.

h. The contractor shall determine adequate memory capacity for all testability requirements, including on-line test and monitoring functions.

Table 6. Full Scale Development SOW Task Statements

2.10 SUBMIT FSD PROPOSAL (DODI 5000.2, SECNAVI 5000.1). Technical and cost proposals for the Full Scale Development (FSD) effort are prepared by the contractors selected to proceed into FSD. These proposals are based on RFP requirements for defined design and development, fabrication and testing of the system, including support equipment and documentation. Contractors will propose how they intend to meet the qualitative vaues of the specialty disciplines, including on-line test and monitoring as specified in the RFP.

2.11 REVIEW AND SELECT FSD PROPOSALS (DODD 5000.1, OPNAVI 5000.1). The procedures for the review and selection of FSD proposals parallels those for the conceptual stage. The increased level of definition in technical and support inputs, design characteristics, DTC/LCC results, and validation results in turn require increased consideration in proposal evaluations. When total demonstration and validation effort is evaluated and decision is made as to which proposal(s) should be selected for full scale development, action is taken to update the DCP. Table 8 contains a checklist of proposal evaluation criteria, as pertains to on-line test and monitoring functions.

2.12 UPDATE DCP (DODI 5000.2, OPNAV 5000.24). Update of the Milestone I DCP is accomplished in preparation for the Milestone II Decision. On-line test and monitoring concepts, goals and thresholds are updated, based on increasing refinement and definition resulting from trade studies, analyses, and validation actions.

2.12.1 DCP Approval (DODD 5000.1, OPNAVI 5000.46). Prior to Milestone II, the DCP is reviewed by the Defense Systems Acquisition Review Council (DSARC) in preparation of recommended action to the SECDEF. Approval by the SECDEF sets Milestone II and ends the Demonstration and Validation Phase of the acquisition.

a. Has on-line test and performance monitoring capability been given consideration appropriate to the mission, support, and functional analyses, for application in the design and performance of the proposed system?

b. Has this capability been reflected in the updated system specification?

c. Are on-line test and monitoring requirements translated to the CI Development Specification Drafts?

d. Do trade studies and analyses reflect the effects of on-line test and monitoring capability on R&M, testability, logistics support, and level of repair in technical as well as cost terms?

e. Have all risks associated with the application of performance monitoring or on-line test been identified and assessed, including the potential impact on reliability, maintainability, and operator skill level requirements?

f. Has the final combination of operations, maintenance, logistics and test requirements affected the overall program concept in any negative manner which is excessively detrimental to the fulfillment of the overall mission needs?

g. Are operational availability, performance, overall supportability and LCC of the proposed system all within prescribed bounds?

Table 7. System Design Review Checklist

The following items of evaluation in which on-line test and monitoring requirements could have impact, should be considered in the evaluation results.

a. Has sufficient consideration been given to the allocation of system specification requirements to lower tier (CI) requirements?

b. Has consideration and application of this capability been made when analysis indicates increased operational efficiency or LCC cost reduction is probable?

c. Has sufficient depth of definition been given to the performance requirements stated in the CI development specifications?

d. Have refined costs (covered partly in "b" above) and refined schedule estimates been made, and are they realistic?

e. Do the breadboard test results of the on-line test and monitoring functions sufficiently validate the requirement?

f. Are the level and mix of on-line test and monitoring applications optimized for the mission need?

g. Are any unique problems or risks evident in the use of this capability?

h. Have all interface requirements (functional and physical) been adequately designed? Are interface control procedures adequate?

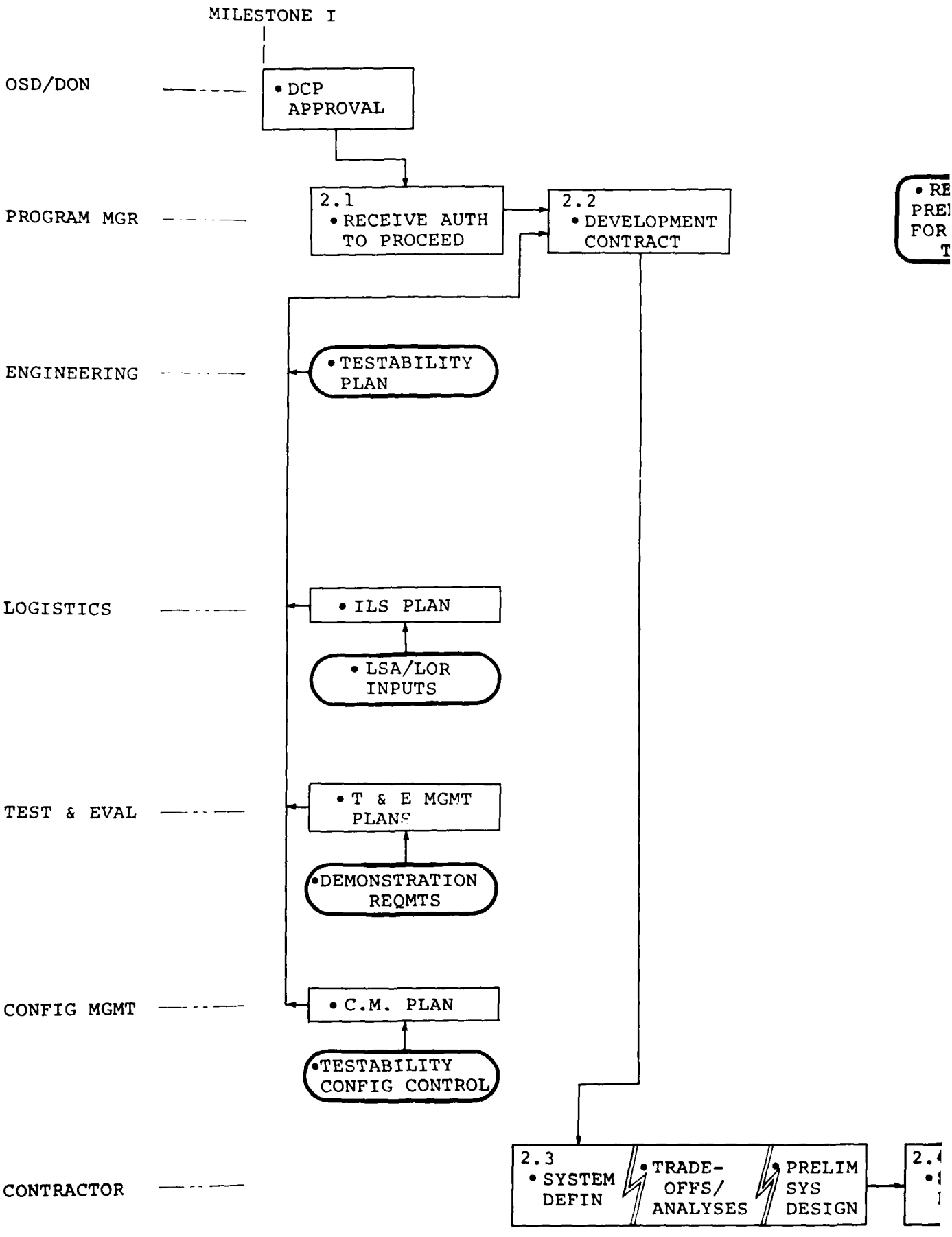
i. Have the risks that on-line test and monitoring impose on other disciplines such as reliability and maintainability been fully considered?

j. Is consideration given in configuration management procedures for tracking and controlling the effect that system design changes or changes in other specialized disciplines may have on the performance monitoring requirements and architecture?

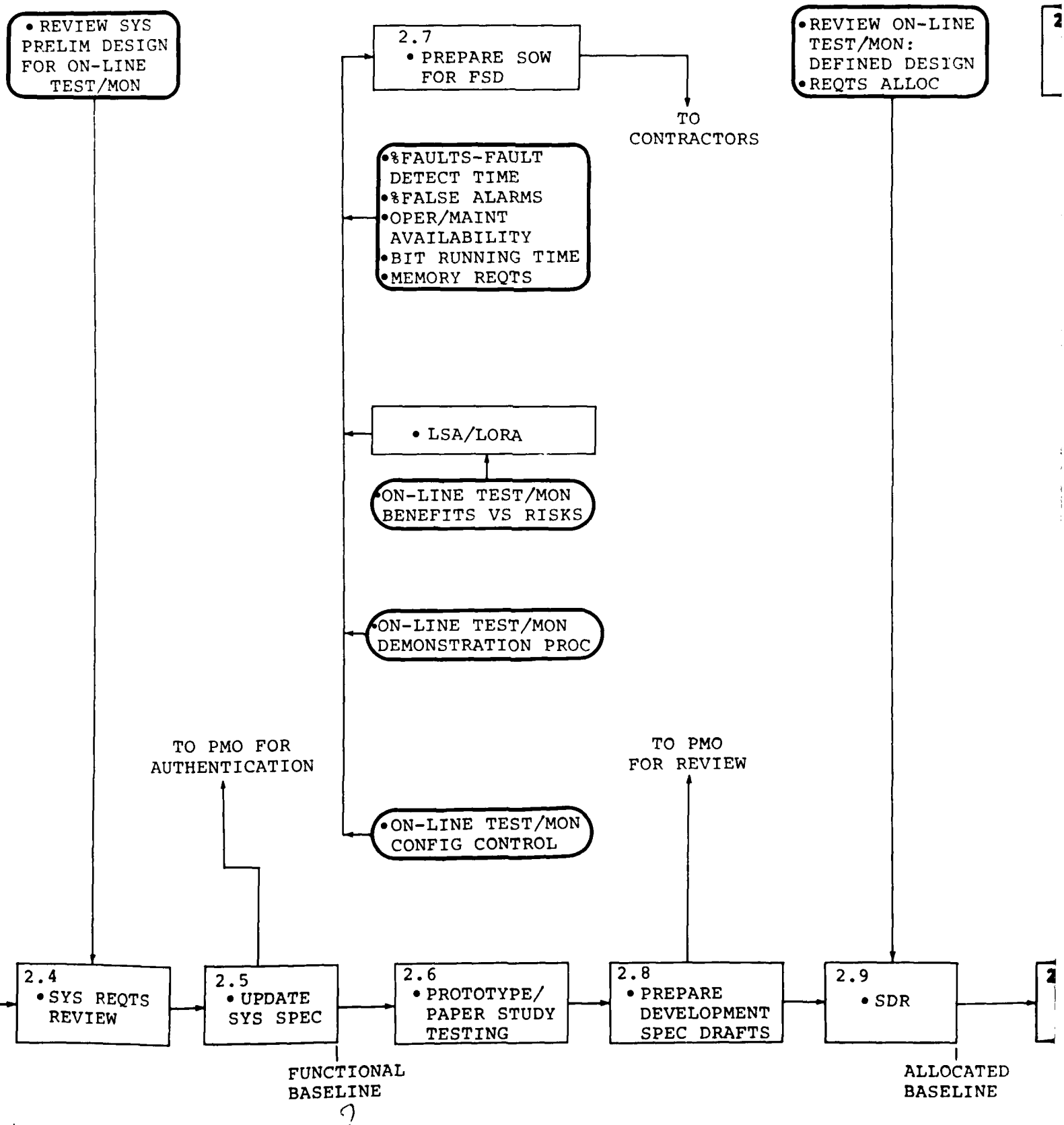
k. Have the offerors identified all on-line test and monitoring parameters subject to having effect in LSAs? Also, do logistics plans provide for refinement of these parameters in LSA iterations?

l. Does the proposed on-line test and monitoring structure fully comply with the RFP, and therfore, mission need requirements?

Table 8. Full Scale Development Proposal Evaluation Checklist


MILESTONE I
OSD/DON
• DCP APPROVAL
PROGRAM MGR
2.1 • RECEIVE AUTH TO PROCEED
2.2 • DEVELOPMENT CONTRACT
ENGINEERING
• TESTABILITY PLAN
LOGISTICS
• ILS PLAN
• LSA/LOR INPUTS
TEST & EVAL
• T & E MGMT PLANS
•DEMONSTRATION REQMTS
CONFIG MGMT
• C.M. PLAN
•TESTABILITY CONFIG CONTROL
CONTRACTOR
2.3 • SYSTEM DEFIN
• TRADE-OFFS/ ANALYSES
• PRELIM SYS DESIGN

- DEMONSTRATION AND VALIDATION PHASE -



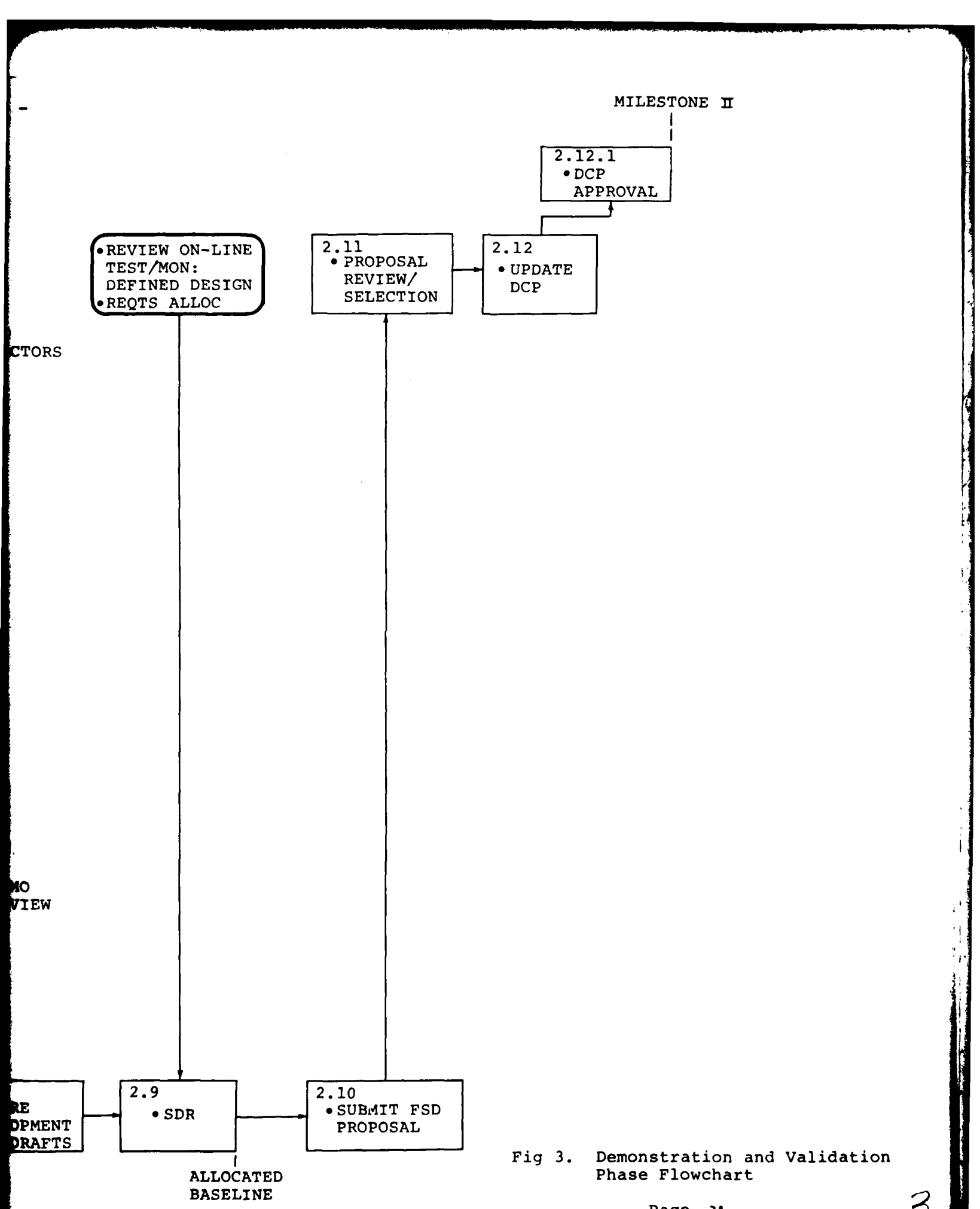


Fig 3. Demonstration and Validation Phase Flowchart

3

SECTION 3

FULL SCALE DEVELOPMENT PHASE

3.0 During this phase of the acquisition, a pre-production prototype of the system, along with documentation needed to produce the system for the operational inventory, is designed, developed, fabricated and tested. Detailed design specifications and drawings are readied in preparation for the increasingly critical design reviews by program managment office and other interested personnel, and specifications and drawings are examined in ever-increasing detail to assure that the configurations are in accordance with the design requirements. The preliminary and critical design reviews afford the last opportunity to consider adequacy of the on-line test and monitoring applications. The flow of activity for this phase is depicted in Figure 4 at the end of this section.

3.1 RECEIVE AUTHORITY TO PROCEED (DODI 5000.2, SECNAVI 5000.1). As at the previous milestone, the SECDEF approval of the DCP constitutes authority to proceed into FSD.

3.2 ISSUE FSD CONTRACT. The technical portion of the FSD contract is constructed from the SOW prepared in the Demonstration and Validation Phase. It is issued to the one or two contractor(s) selected to pursue full-scale development of their proposed systems.

3.3 CONTRACTOR TRADE-OFF, INITIAL DEVELOPMENT, PRELIMINARY DESIGN ACTIVITY (MIL-STD-1388). The ever-increasing formalization of the design process in this phase calls for continuous LSA refinement and updating. This provides in-depth design feedback of the various engineering specialty areas which have impact on testability and the ability to monitor system performance. Examples are: (a) the Failure Mode and Effects Analysis (MIL-STD-785), and (b) Mean Time to Repair data (MIL-STD-470), both required in the quantification of test and monitoring design factors such as fault detection and isolation times, false alarm data and BIT running times. These LSA-derived design factors are "traded off" with cost and time criteria.

3.4 FINALIZE HARDWARE/SOFTWARE CI DEVELOPMENT SPECIFICATIONS (MIL-STD-490, MIL-STD-483). The draft Development Specification for each configuration item is updated by the contractor(s) based on comments received from the program management office (PMO) review, and any PMO-negotiated changes resulting from on-going LSA refinement. These finalized specifications are forwarded to the PMO for authentication, establishing the performance and test criteria on which the program is design and developed.

3.5 PRELIMINARY DESIGN REVIEW (PDR) (MIL-STD-1521). The PDR is conducted to document and evaluate the selected design approach, technical adequacy, and risk resolution on cost and schedule bases at the configuration item level. The review will include those design products in which on-line test and monitoring requirements have impact. Table 9 contains a checklist of on-line test and monitoring items for consideration during PDR.

3.6 ON-GOING DT&E (DODD 5000.3, SECNAV 5000.1). Tests and evaluations in the FSD, including development qualification testing, are conducted to reduce the risk of the system or equipment being unable to meet specified performance, or the risk of being incapable of employment in the intended operational environment. Testing and evaluation plans, procedures and results are reviewed during the engineering reviews to insure that design and performance requirements, including on-line test and monitoring requirements, meet specification and thus support milestone decisions.

3.7 DETAIL DEVELOPMENT DESIGN. On successful completion of the PDR, and as the system engineering process continues, detail design for hardware and software elements evolve from the preliminary design state. Progressive LSA and LORA are used to derive a definitive support posture for the resultant products. As may be necessary, prototype hardware/software items are fabricated to test/verify the on-line test and monitoring functions (among the other specialty engineering requirements).

3.8 DRAFT PRODUCT HARDWARE/SOFTWARE SPECIFICATIONS (MIL-STD-490, MIL-STD-483). The CI Product Specification(s) is initiated as detail design data evolves as a result of the continuing system engineering process. On completion of the specification(s) and in preparation for the Functional Configuration Audit and the Critical Design Review, draft copies are forwarded to the PMO for review.

3.9 FUNCTIONAL CONFIGURATION AUDIT (FCA) (MIL-STD-1521). The FCA is a formal examination of the Configuration Item (CI) test data. Test results and procedures (or adequate analyses or simulation as may be accepted), are reviewed to verify achievement of the CI's performance specified in the Development Specification.

3.10 CRITICAL DESIGN REVIEW (CDR) (MIL-STD-1525). The CDR is conducted prior to fabrication/production release to insure that the Development Specification performance requirements are satisfied by the detail design solutions reflected in the draft Product Specification and engineering drawings. During the CDR, the contractor is also required to show compatibility of functional and physical interfaces, both internal and external, to the CI. Table 10 contains a checklist of on-line test and monitoring items of interest during the CDR.

a. Equipment Configuration Items

1. Do the performance characteristics for testability, as authenticated in the system specification, translate into CI-level performance requirements?

2. Have trade-studies regarding reliability, maintainability and testability been completed with results incorporated into system design?

3. Has BITE versus Electronic Test Equipment (ETE) study been performed, and results employed in design?

4. Has provision for self-test firmware been made in equipment/performance design? Have provisions been made for micro-program diagrams and descriptions of algorithms for instruction translation, fabrication and packaging (integration technology), and special equipment and support software needed to develop and test the self-test firmware?

b. Support Equipment

1. Has the optimal Support Equipment arrangement consisting of BITE and/or separate test equipment (ETE/ATE) been arranged?

c. Design for Reliability, Maintainability and Testability

1. Review the contractor's planned actions for adequacy when predictions indicate that specified requirements will not be attained.

2. Review the adequacy of the testability planning data to insure that the indicated self-test and performance monitoring design principles provide adequate and mature overall testability and monitor capability design. Verify that contractor design engineers and engineering management follow this planning data.

3. Insure that human factor considerations that are pertinent to self-test and performance monitoring have been given adequate consideration. Have factors of display techniques, control and data entry devices, as well as status, error and data printout messages (as appropriate) all been considered, individually and in concert, as to their usability from the human interface standpoint?

Table 9. Preliminary Design Review Checklist

For each CI, review the adequacy of the detail design of the draft Product Specification, for compatibility with the Development Specification performance requirements.

a. Review the adequacy of the detailed design in the areas of reliability, maintainability and testability. Do all details of self-test or performance monitoring design functions satisfy the requirements of the Development Specification while having no negative impact upon system reliability, maintainability, etc.

b. Similarly, review self-test routines (diagnostic procedures) contained within firmware to be provided for the system, for adequacy of detail design and compliance with the other engineering specialty disciplines.

c. Identify Design For Testability (DFT) criteria provided by the Full Scale Development SOW task statements, to insure that criteria have been incorporated.

d. Identify any unique self-test/performance monitoring procedures required for each CI when in operational use, and evaluate their effect on system test and maintenance concepts. Assure that the system is optimized from the performance monitoring point of view.

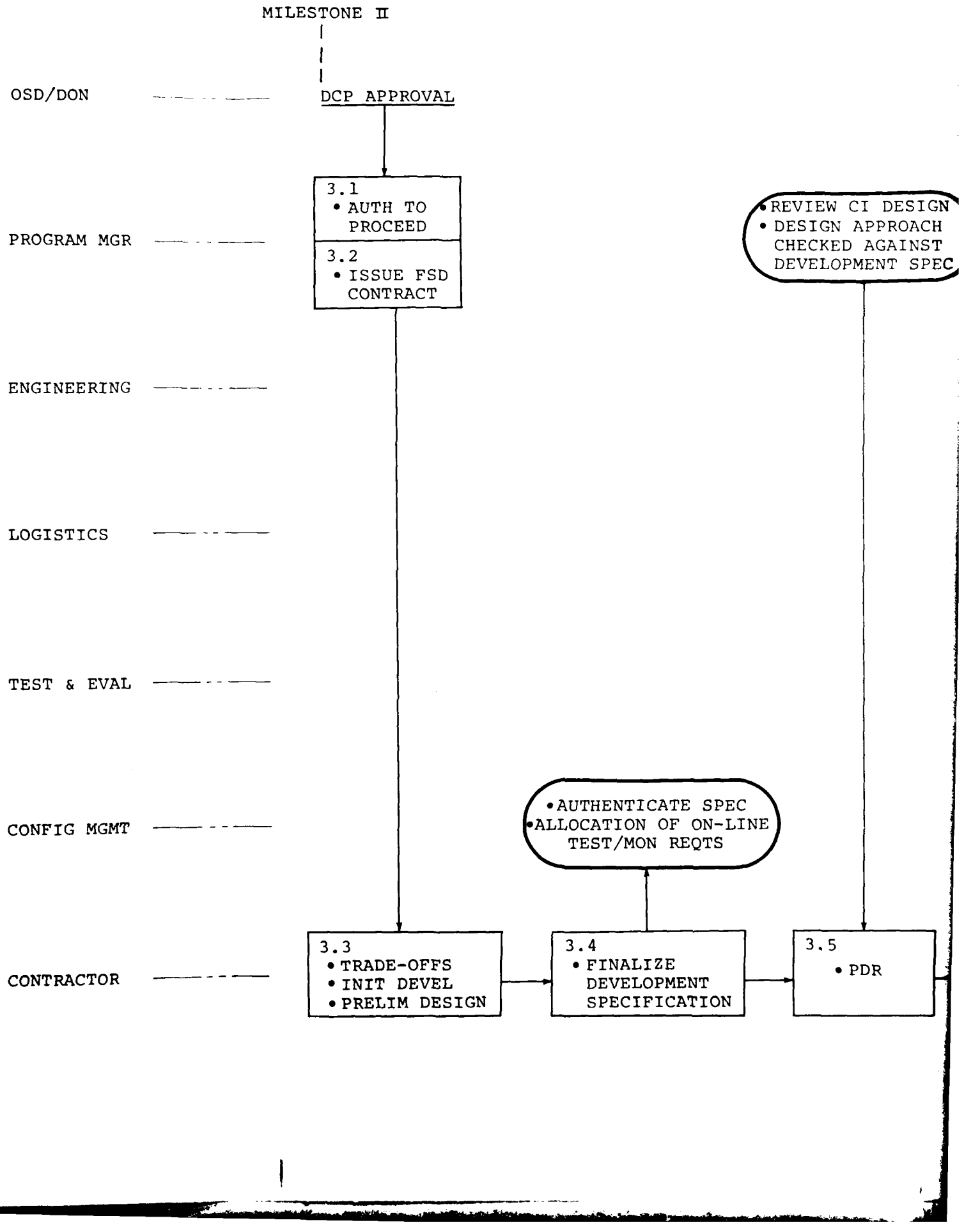
e. Review performance monitoring or BIT for adequacy of coverage as well as compatibility with overall mission requirements. Does it interface well with the CI primary functions without degradation of performance, while being adequate in the human factors viewpoint as well?

Table 10. Critical Design Review Checklist

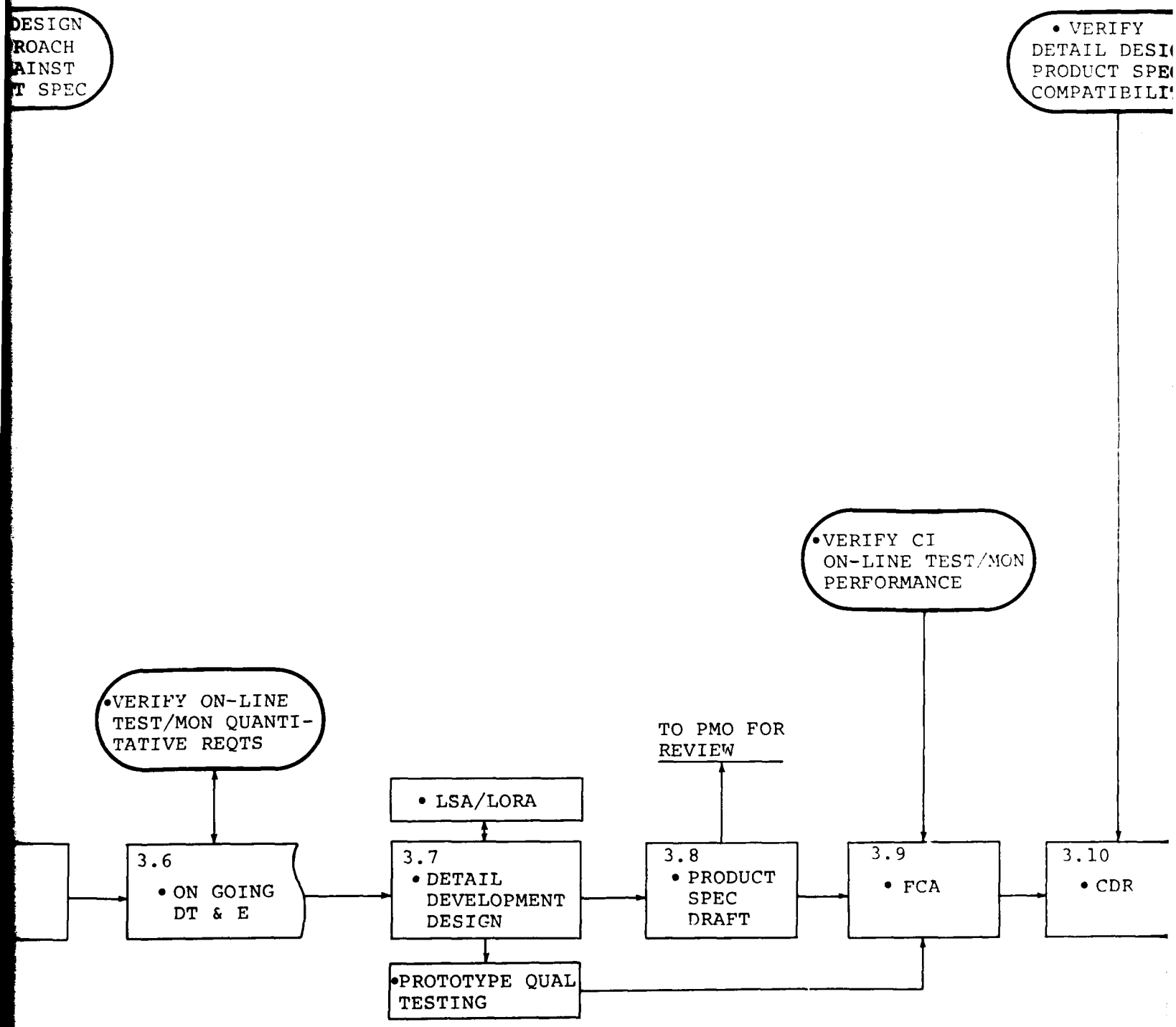
3.11 FINALIZE PRODUCT SPECIFICATIONS (MIL-STD-490, MIL-STD-483). The draft Product Specification for each configuration item is updated by the contractor(s) based on comments received from the program management office review, as well as any PMO-negotiated changes resulting from on-going LSA refinement. As they are finalized, these specifications are forwarded to the PMO for review. When authenticated, they become the basis for the engineering drawings on which production is based. Authentication of each Product Specification establishes the Product Baseline for the CI. A limited number of the items may be produced for qualification testing after authorization of the Product Specification has been made.

3.12 UPDATE DCP (DODI 5000.2, OPNAV 5000.46). In preparation of the Milestone III decision to proceed into the Production Phase, the previous (Milestone II DCP) is finalized with updated goals and thresholds based on the detailed and firm "build-to" specification and engineering drawing products of the FSD phase.

3.12.1 DCP Approval (DODD 5000.1, OPNAVI 5000.46). As previously stated, approval of the DCP constitutes authority to proceed to the next phase of acquisition, in this case, Production and Deployment.


MILESTONE II
OSD/DON
DCP APPROVAL
PROGRAM MGR
3.1
• AUTH TO PROCEED
3.2
• ISSUE FSD CONTRACT
• REVIEW CI DESIGN
• DESIGN APPROACH CHECKED AGAINST DEVELOPMENT SPEC
ENGINEERING
LOGISTICS
TEST & EVAL
CONFIG MGMT
• AUTHENTICATE SPEC
• ALLOCATION OF ON-LINE TEST/MON REQTS
CONTRACTOR
3.3
• TRADE-OFFS
• INIT DEVEL
• PRELIM DESIGN
3.4
• FINALIZE DEVELOPMENT SPECIFICATION
3.5
• PDR

- FULL SCALE DEVELOPMENT PHASE -



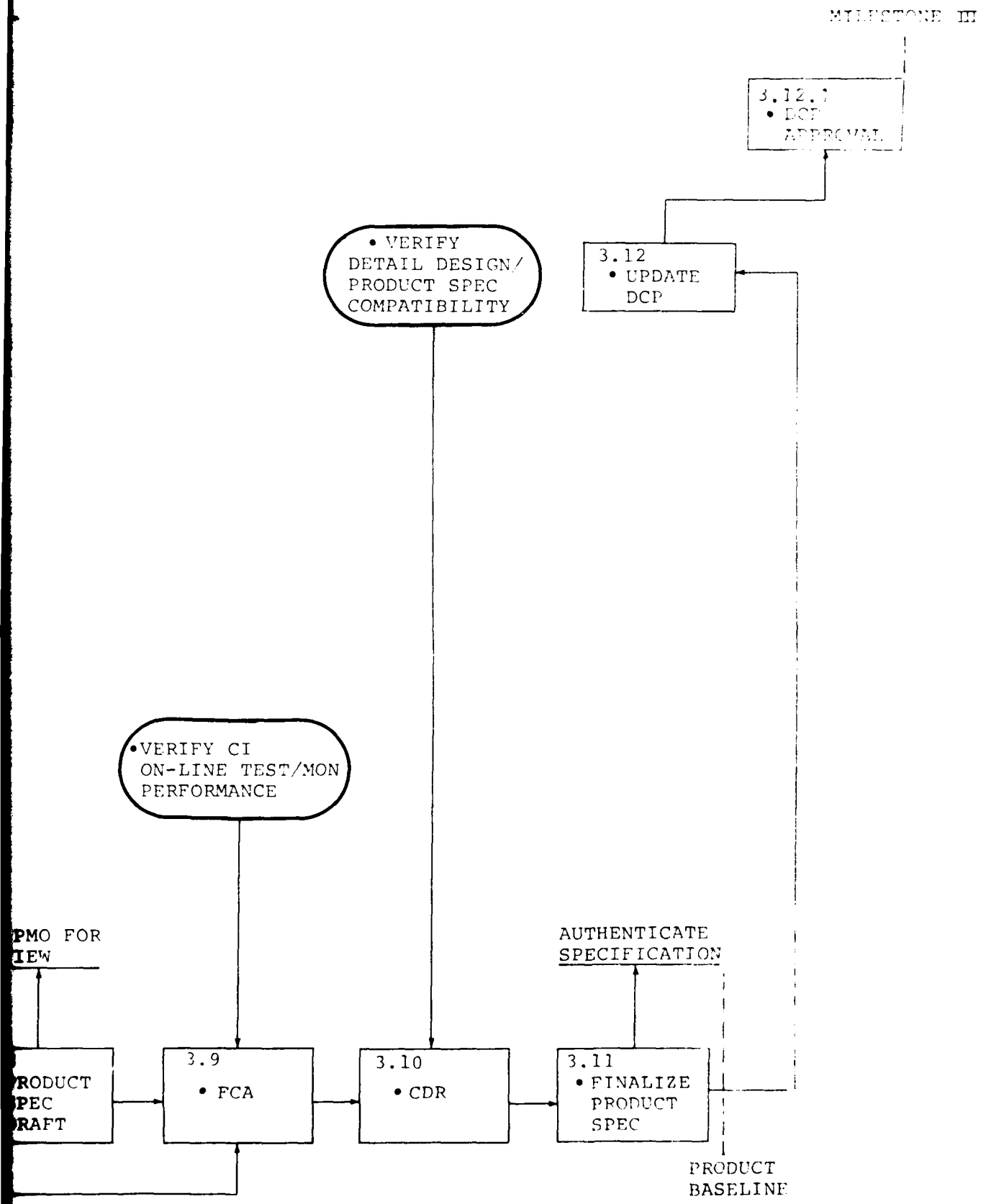


Fig 4 Full Scale Development Phase

SECTION 4

PRODUCTION AND DEPLOYMENT PHASE

4.0 During the Production and Deployment phase, the system, including support and training equipment, is produced for operational use. Production units are selectively acceptance-tested by Government personnel. Operational Test and Evaluation is conducted under actual operational conditions in preparation for delivery to the operational forces. All verification of hardware/software compliance with final specification requirements should be completed during this phase. System elements are integrated into a complete system to be tested for compliance with the system specification. Finally the configuration management process is continued into deployment for design feedback as may be made necessary by engineering changes. The flow of activity for this phase is depicted in Figure 5 at the end of this section.

4.1 START PRODUCTION. Following the Milestone III decision, the commitment for production is made contractual based on the authenticated "build-to" Production Specification(s).

4.2 PHYSICAL CONFIGURATION AUDIT (PCA) (MIL-STD-1521, MIL-STD-483). The function of the audit team, is to verify that the as-built version of First Article CIs conform to the Production Specifications. It also includes an audit of specifications and techical data such as engineering drawings for hardware items and users' manuals for software items. Acceptance test procedures are reviewed for adequacy during the PCA. Finally, engineering release documents and quality control records are checked against the as-built configuration of the article and its related documentation to insure late design changes are incorporated. This is especially important in self-testing and monitoring functions in the interest of eliminating false monitoring and testing ambiguities.

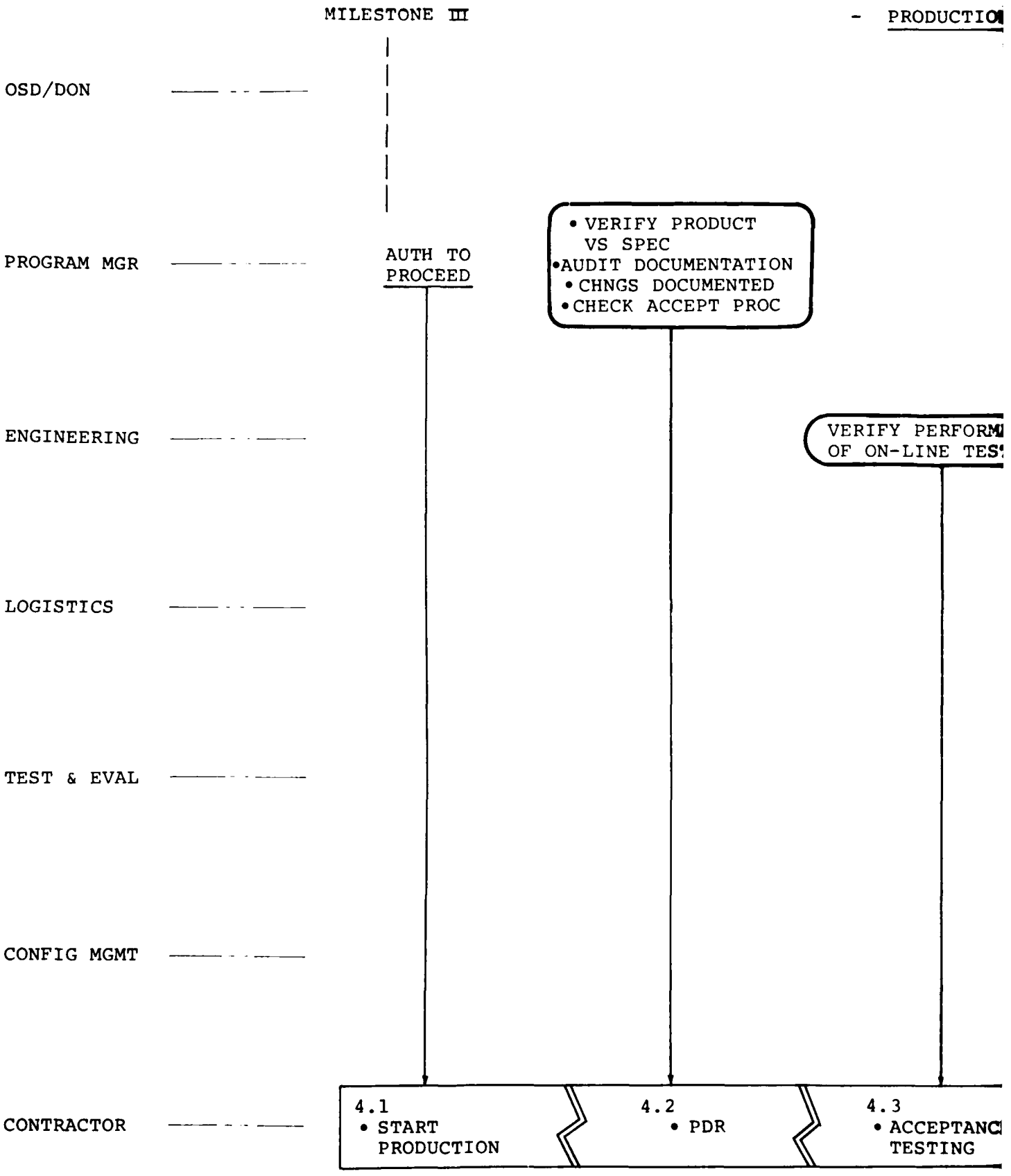
4.3 ACCEPTANCE TESTING. Production acceptance tests are conducted in accordance with the quality assurance provisions in Section 4 of each Configuration Item Product Specification. Validation/verification of on-line test and monitoring performance should be considered as a special acceptance test requirement.

4.4 OPERATIONAL TEST AND EVALUATION (OT&E). As initial CIs are placed into service, OT&E takes on greater significance. Within the OT&E effort, service tests of reliability and maintainability are conducted to verify related quantitative data. The closely allied 'testability' discipline should also be included in OT&E planning to require verification of applicable on-line test and monitoring quantitative requirements.

4.4.1 Design Feedback. Any discrepancies discovered in OT&E that require design changes must be fed back through the contractor's configuration management system to maintain configuration control of the item/system. Resultant impact upon on-line test and monitoring circuits/structure must be considered to insure minimization of false alarms in test and monitoring performance.

4.5 OPERATIONAL USE. The operational forces also conduct suitability tests oriented to tactical use on units received directly from production.

4.5.1 Engineering Changes. Any required engineering changes are similarly entered into the engineering change process for design feedback to insure that impact on all functional and performance areas is considered.


MILESTONE III
- PRODUCTIO
OSD/DON
PROGRAM MGR
ENGINEERING
LOGISTICS
TEST & EVAL
CONFIG MGMT
CONTRACTOR
AUTH TO PROCEED
• VERIFY PRODUCT VS SPEC
•AUDIT DOCUMENTATION
• CHNGS DOCUMENTED
• CHECK ACCEPT PROC
VERIFY PERFORM
OF ON-LINE TES
4.1
• START PRODUCTION
4.2
• PDR
4.3
• ACCEPTANC
TESTING

PRODUCTION AND DEPLOYMENT PHASE -

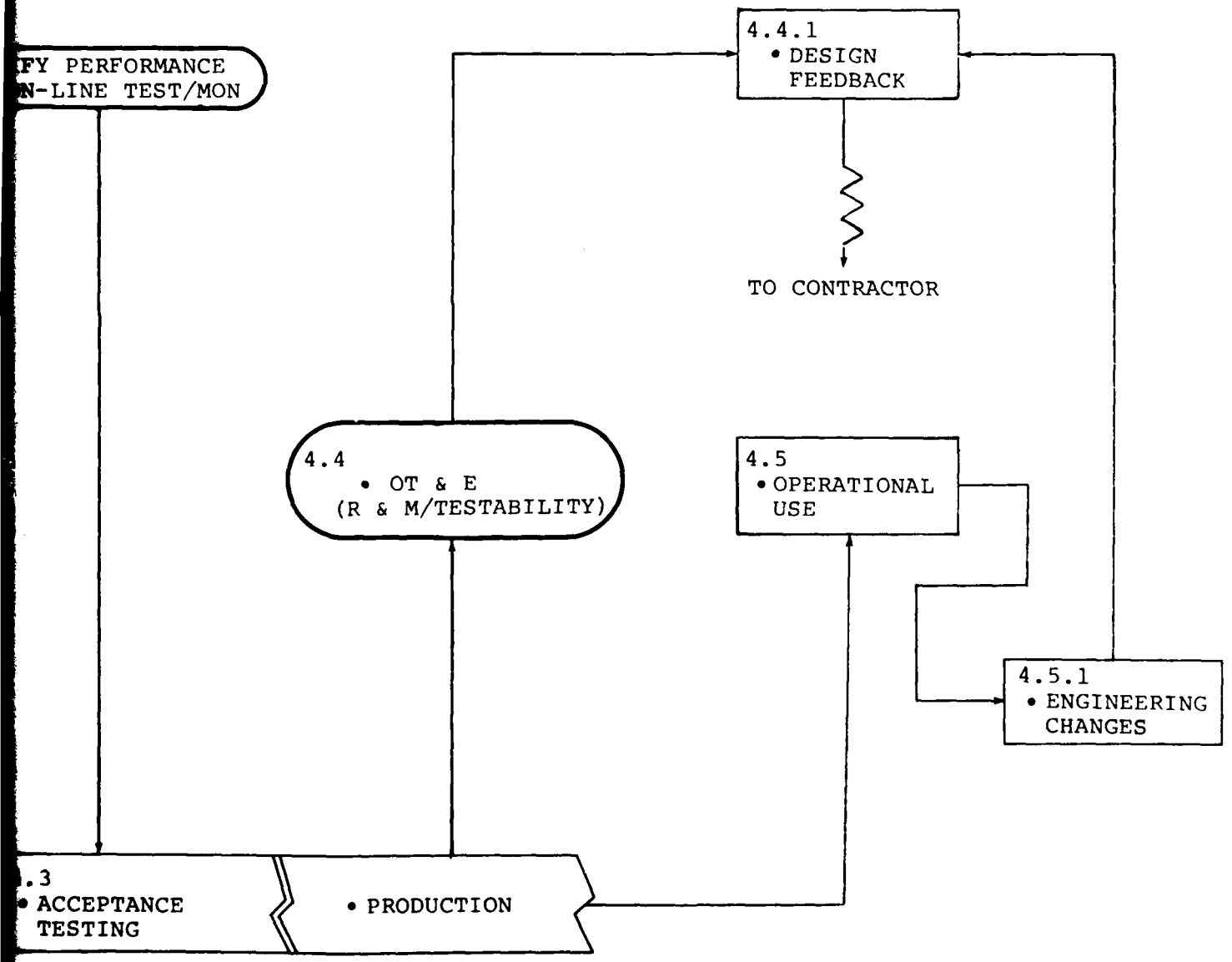


Fig. 5 Production and Deployment Phase

List of Acronyms

ATE	Automatic Test Equipment
BIT	Built-In-Test
BITE	Built In Test Equipment
CDR	Critical Design Review
CI	Configuration Item
CM	Configuration Management
CMP	Configuration Management Plan
DCP	Decision Coordination Paper
DFT	Design For Testability
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DSARC	Defense Systems Acquisition Review Council
DTC	Design To Cost
DT&E	Development Test and Evaluation
ETE	Electronic Test Equipment
FCA	Functional Configuration Audit
FSD	Full Scale Development
IC	Integrated Circuit
ILS	Integrated Logistic Support
ILSP	Integrated Logistic Support Plan
LCC	Life Cycle Cost
LOR	Level Of Repair
LORA	Level of Repair Analysis
LSA	Logistics Support Analysis
LSI	Large Scale Integration
MENS	Mission Element Need Statement
MIL-HDBK	Military Handbook
MIL-STD	Military Standard
MSI	Medium Scale Integration
MTFL	Mean Time to Fault Locate
MTTR	Mean Time To Repair

List of Acronyms, Continued

NAVMAT	Naval Material
OMB	Office of Management and Budget
OT&E	Operational Test and Evaluation
PCA	Physical Configuration Audit
PDR	Preliminary Design Review
PM	Program Manager
PMO	Program Manager Office
RFP	Request For Proposal
R&M	Reliability and Maintainability
SDR	System Design Review
SECDEF	Secretary of Defense
SEMP	System Engineering Management Plan
SOW	Statement Of Work
SRR	System Requirement Review
SYSCOM	Systems Command
TD	Technical Document
TEMP	Test & Evaluation Master Plan
T&E	Test and Evaluation
VLSI	Vary Large Scale Integration